

Anders Warén\* and Philippe Bouchet\*\*

A NEW SPECIES OF VANIKORIDAE FROM THE WESTERN  
MEDITERRANEAN, WITH REMARKS ON THE NORTHEAST ATLANTIC  
SPECIES OF THE FAMILY\*\*\*

### Abstract

*Macromphalus abyensis* is described from Ceuta, SE part of the Strait of Gibraltar. The external morphology of the soft parts is described and compared with *Vanikoro* sp. *Couthouyia* A. ADAMS, 1860 is synonymized with *Macromphalus* S.V. WOOD, 1842 and transferred from the Fossariidae to the Vanikoridae.

The nomenclature of the species usually called *Megalomphalus azonus* (BRUSINA, 1865) is discussed and it is concluded that two, perhaps three species have been mixed under this name and its synonymy. One of these, previously known as *M. depressus* (SEGUENZA, 1874) has to take the name *M. disciformis* TIBERI Ms, GRILLO 1877, because of secondary homonymy.

The animal of *M. azonus* is figured and the genus is referred to the Vanikoridae. *Megalomphalus mercatoris* ADAM & KNUDSEN, 1969, from Guinea, West Africa, is synonymized with *Megalomphalus disciformis* (GRILLO). *Macromphalina bouryi* (DAUTZENBERG, 1912) and *M. dautzenbergi* ADAM & KNUDSEN, 1969 from West Africa are considered distinct species and transferred to *Megalomphalus*.

*Rissoa cortacea* MANZONI, 1868 (from Madeira) is made the type species of a new genus, *Talassia*, which on the basis of radular and soft part characteristics is placed in the Vanikoridae. *Rissoa tenuisculpta* WATSON, 1873, from Madeira and *Salassia dagueneti* DE FOLIN, 1873 from N Spain are referred to *Talassia* and considered distinct from *cortacea* but it is left open whether *tenuisculpta* and *dagueneti* represent one or two species. *Cingula sandersoni* VERRILL, 1884 from the US Atlantic coast and *Rissoa?* *macrostoma* THIELE, 1925 from the Agulhas Bank are also referred to *Talassia*. The two epitonid genera *Berthais* MELVILL, 1904 and *Constantia* A. ADAMS, 1860 are tentatively transferred to Vanikoridae and *Berthais* is probably a junior synonym of *Cymenorhytis* COSSMANN, 1888.

A new genus, *Tjaernoeia*, is introduced for *Fossarus monterosati* GRILLO, 1877 (= *Fossarus excavatus* MONTEROSATO, 1875 (nom. nud.) = *Adeorbis exquisitus* JEFFREYS, 1883 = *Adeorbis imperspicuus* CHASTER, 1895) which is tentatively placed in the Pyramidellidae.

The genus *Daronia* A. ADAMS, 1861, which recently has been used for this species is shown to belong to the family Poteriidae (Cyclophoroidea) and to be an older name for *Buckleyia* HIGGINS, 1872.

The family Vanikoridae has not previously been reported from the Mediterranean or Europe. A tentative diagnosis of the family is given on the basis of the new information presented here.

\* Naturhistoriska Riksmuseet - Box 50007, S-104 05 Stockholm, Svezia

\*\* Muséum National d'Histoire Naturelle - 55, rue de Buffon, 75005 Paris Cedex 05 - Francia

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## Riassunto

*Macromphalus abyensis* n. sp. è stato segnalato a Ceuta (a sud est dello stretto di Gibilterra). Ne viene descritta la morfologia esterna delle parti molli, comparandola con quella di *Vanikoro* 1sp. *Couthouyia* A. ADAMS, 1860 viene posto in sinonimia con *Macromphalus* S.V. WOOD, 1842 e trasferito da Fossaridae a Vanikoridae.

Si pone in discussione la nomenclatura comunemente usata per *Megalomphalus azonus* (BRUSINA, 1865) e se ne conclude che due, o forse tre specie, sono state confuse con questo nome e relative sinonimie. Una di queste, nota come *M. depressus* (SEGUENZA, 1874) deve prendere il nome, per onomimia secondaria, di *M. disciformis* (TIBERI ms. GRILLO, 1877).

Viene raffigurato l'animale di *M. azonus* e il genere è attribuito alla famiglia Vanikoridae. *Megalomphalus mercatoris* ADAM & KNUDSEN, 1969 (specie della Guinea, Africa occidentale), viene posta in sinonimia con *Megalomphalus disciformis* (GRILLO), mentre *Macromphalus bouri* (DAUTZENBERG, 1912) e *M. dautzenbergi* ADAM & KNUDSEN, 1969, entrambe del W. Africa, sono considerate specie distinte e trasferite nel gen. *Megalomphalus*.

*Rissoa coriacea* MANZONI, 1868 (da Madera) costituisce la specie tipo di un nuovo genere *Talassia*, che, per le caratteristiche radulari e delle parti molli, viene posto nella fam. Vanikoridae. *Rissoa tenuisculpta* WATSON, 1873 (da Madera) e *Salassia degueneti* DE FOLIN, 1873 (dal Nord della Spagna) vengono entrambe attribuite al gen. *Talassia* e considerate distinte da *coriacea*: resta tuttavia aperto il problema se *tenuisculpta* e *degueneti* debbano considerarsi specie distinte oppure la medesima specie.

Equalmente da attribuire al gen. *Talassia* sono *Cingula sandersoni* VERRILL, 1884 (coste atlantiche U.S.A.) e *Rissoa* ? *macrostoma* THIELE, 1925 (da Agulhas Bank). I due generi di Epitoniidae *Berthais* MELVILL, 1904 e *Constantia* A. ADAMS, 1860 sono provvisoriamente posti nella fam. Vanikoridae: *Berthais* è probabilmente un sinonimo jun. di *Cymenorthytis* COSSMANN, 1888.

Un nuovo genere, *Tjaernoeia*, viene proposto per *Fossarus monterosati* GRILLO, 1877 (= *Fossarus excavatus* MONTEROSATO, 1875 (nom. nud.) = *Adeorbis exquisitus* JEFFREYS, 1883 = *Adeorbis imperspicuus* CHASTER, 1895) ed è posto provvisoriamente nella fam. Pyramidellidae. Il genere *Daronia* A. ADAMS, 1861, usato anche recentemente per questa specie, appartiene invece alla fam. Poteriidae (Cyclophoroidea) ed è da considerarsi un nome più antico di *Buckleyia* HIGGINS, 1872.

La famiglia Vanikoridae non fu sinora segnalata per il Mediterraneo e i mari europei: a titolo di tentativo, sulla scorta delle nuove informazioni presentate in questo lavoro, ne viene esposta la diagnosi.

## Introduction

During a recent excursion to Ceuta, SE part of the Strait of Gibraltar, to investigate the mollusc fauna of that area, we obtained live specimens of a species figured by VAN AARTSEN et al. (1984, fig. 392) as *Fossarus* sp. Examination of the soft parts showed that the species should be referred to the Vanikoridae. As we have accumulated notes on radulae and soft parts of other species from the Mediterranean that properly should be included in that family, we find it suitable to include these to give a review of what is known about the vanikorids in the northeast Atlantic.

### Abbreviations:

MNHN - Museum National d'Histoire Naturelle, Paris

SMNH - Swedish Museum of Natural History, Stockholm

## Family **Vanikoridae** GRAY, 1840 (ICZN Op. 1009)

The family Vanikoridae presently (WENZ 1940, BOSS 1982) contains a single recent genus, *Vanikoro* QUOY & GAIMARD, 1832, with numerous species living in shallow water all over the tropical and subtropical areas. The species were revised by E.A. SMITH (1908) and the generic name was stabilized by the ICZN (Opinion 1009) after an application by R. ROBERTSON (1962). The anatomy of *Vanikoro* has been roughly described by RECLUZ (1845), BOUVIER (1887), BERGH (1896), RISBEC (1955) and THIELE (1929) and BOSS (1982) summarized this. RISBEC (1931) and CERNOHORSKY (1978) described the egg-capsules.

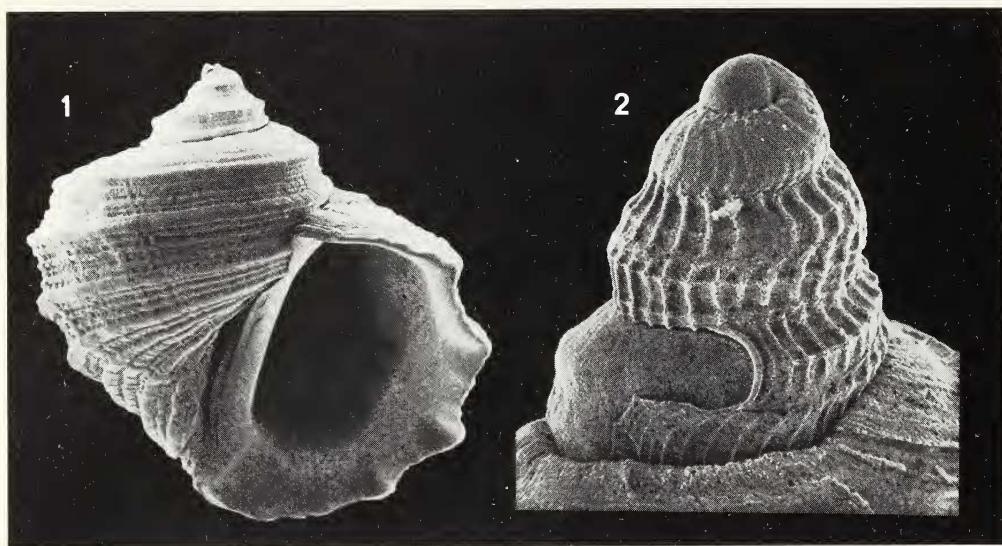
WARÉN (unpublished) found *Vanikoro* sp. several times in shallow water in N Queensland, Australia, attached by the posterior, sucker-like portion of the foot to the underside of rocks and coral boulders which were shallowly buried in sand. The species usually occurred in couples of a female and a smaller male, often together with the dark green egg capsules. When detached, the animals did not reattach when kept in a tank with running sea water for several days. The animals thus seem to be quite sedentary.

Some paleontologists have had a somewhat different concept of the family Vanikoridae, compared with the traditional one. Among these COSSMANN (1925) and GOUGEROT & LE RENARD (1981) have put forth an arrangement that largely agrees with our results, but already MONTEROSATO (1877: 33) advocated that «*Fossarus*» *azonus* (BRUSINA) is related to *Vanikoro*.

Most of the species discussed below were previously included in the family Fossaridae and we will therefore summarize the knowledge of that little known family.

PHILIPPI (1841) described the genus *Fossarus* and figured the type species, *Helix ambigua* LINNÉ, 1758 alive. TROSCHEL (1856-63) examined the radula and made a new family, Fossaridae, for it. RECLUZ (1864) discussed the genus and made a wider generic diagnosis which, however, is of no value since the two additional species he included later were referred to the Pyramidellidae (THIELE 1925, PONDER in press). FISCHER (1864) listed the known species. TRYON (1888) and others have monographed the family, but no additional information was published until THIELE (1925) published a more accurate drawing of the radula. At the same time THIELE discussed and described two other genera, *Couthouyia* A. ADAMS, 1860 and *Fossarella* THIELE, 1925 which he considered to belong to the Fossaridae. Therefore it is difficult to say how much of his (1929) (and BOSS's 1982) characterization of the family Fossaridae that is based on *Fossarus* and what is based on the two genera *Fossarella* and *Couthouyia*. He pointed out the similarity to the Vanikoridae and included the two families in the «Amaltheacea» (=Hipponicoidea) (1925, 1929). We assume that his opinion about similarity was based on similarities of soft parts between those of *Couthouyia* and *Fossarella* compared with those of *Vanikoro*, because he did not mention anything about the soft parts of *Fossarus*, except the radula, of which the central tooth shows some resemblance to the Vanikoridae.

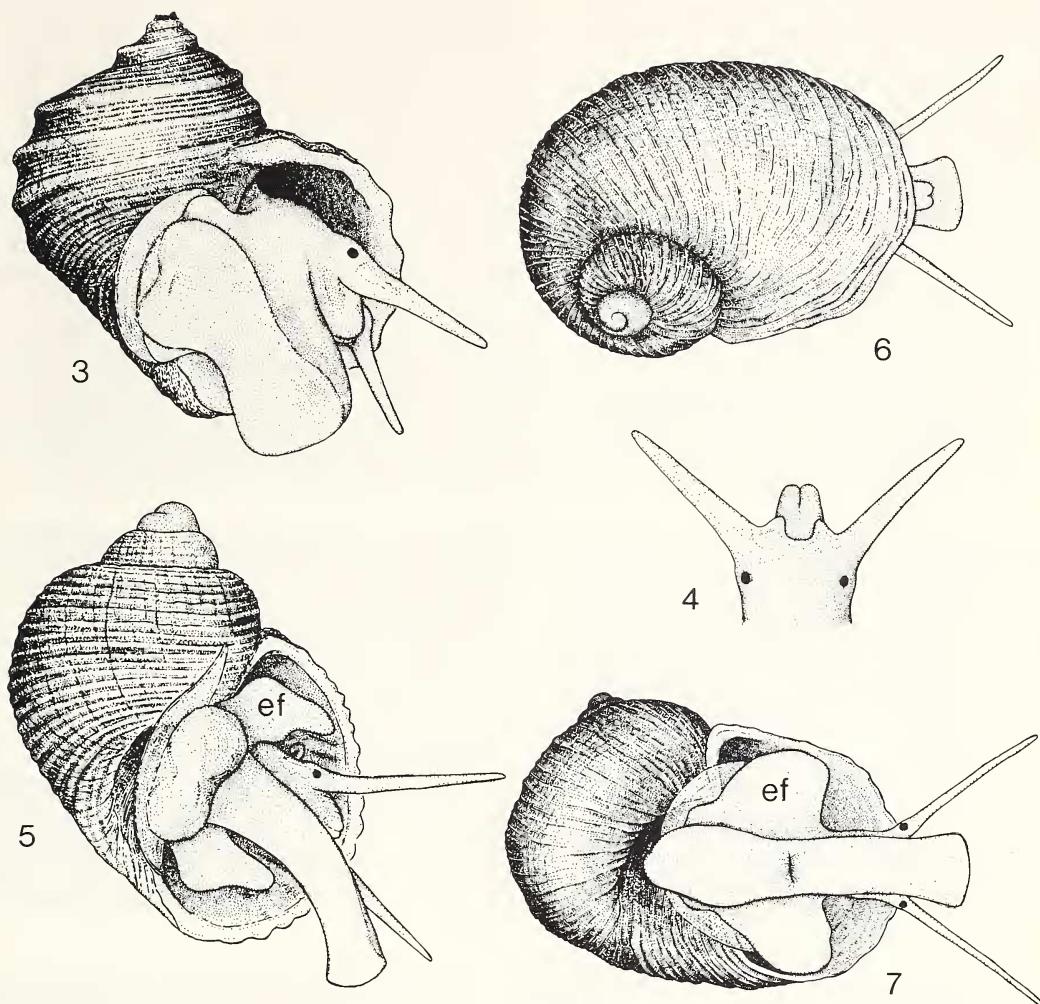
MONTEROSATO (1902) in a short note pointed out that both *Planaxis* and *Fos-*



Figs. 1-2. *Fossarus ambiguus*. -1. Adult shell, Sicily, 2.5 mm. (SMNH) -2. Protoconch, Calvi, Corsica, height 290  $\mu$ m.

*sarus* have a cephalic brood pouch and suggested that the two families are related.

WARÉN (unpublished) has observed live specimens of *Fossarus ambiguus* during a stay at «Station de Recherches Sousmarines et Océanographiques», Calvi, Corsica, where it was commonly found in cavities in the «trottoir», the characteristic shelf of calcareous algae often bordering rocky shores in the Mediterranean (DELAMARE-DEBOUTTEVILLE & BOUGIS, 1951). They often occurred in small groups of 2-6 specimens and evidently they may spend their whole life in the same cavity as these often lacked exits large enough for the snails to exit. Figs 3-4 are prepared from a specimen from Calvi. PHILIPPI's (1841, pl 5 figs 1, 4) drawing of the snail is essentially correct, although he has drawn the foot too slender. He did, however, mention in the text that it is of about the same length as the shell when crawling, almost round when resting. It should be added that the tentacles are thick and somewhat triangular in cross section, with an indistinctly serrated dorsal edge or ridge close to the outer side. The tentacles are united to each other by a thin membrane over the snout and



Figs. 3-7. -3-4. *Fossarus ambiguus* after sketches from Calvi, Corsica. -5. *Macromphalus abyensis*, after sketches from Ceuta. Note the rudimentary penis. -6-7. *Megalomphalus azonus*, after sketches from Golfe de Gabés. EF - epipodial fold.

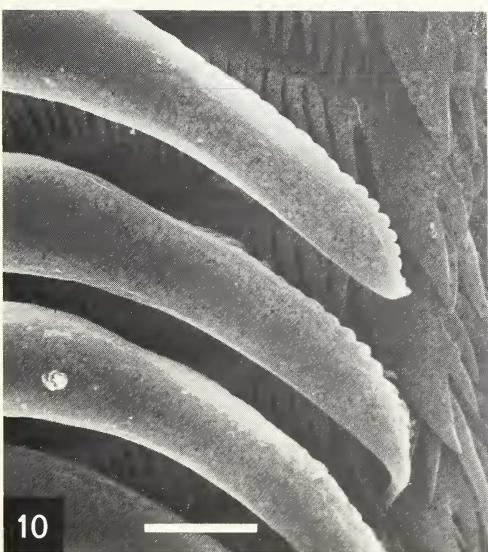
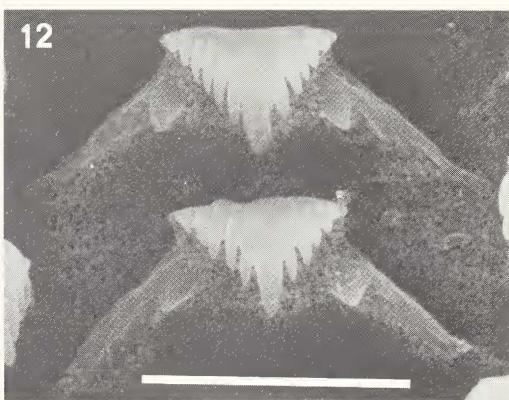
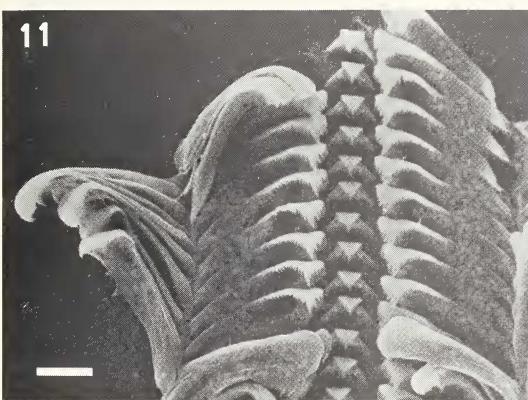
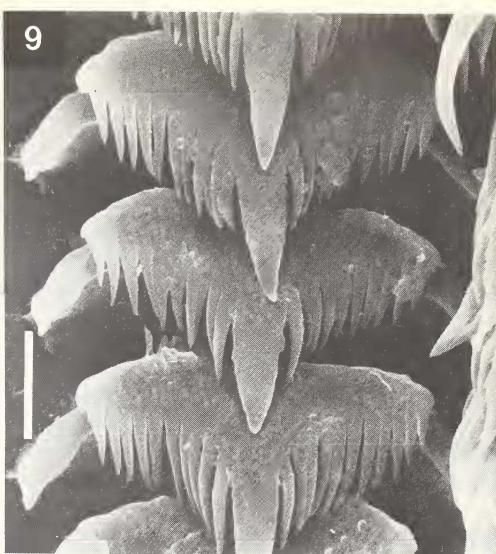
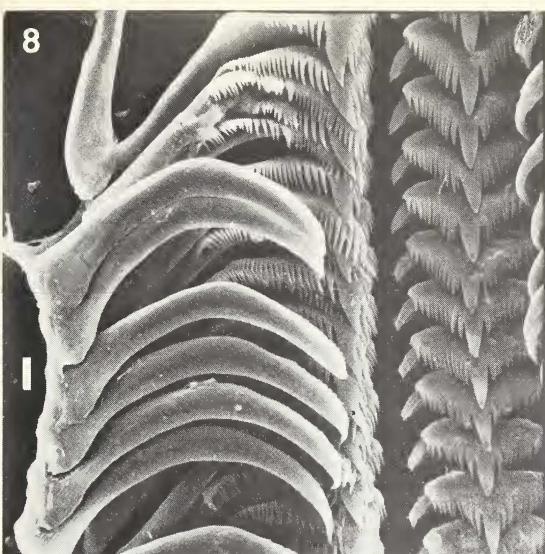
equipped with a distinct bulge at the inner, central bases. The propodium is indistinct, separated by a shallow furrow along the anterior edge of the foot. There are no pedal or pallial appendages. The animal crawls with the head in front of the anterior edge of the foot. No specimen with a penis was found although several males were examined. The shell, operculum and radula are figured in figs 1-2, 11-13, 24-25. No females with a developed brood pouch were found at this time of the year (March-April). Nothing has been published about the internal anatomy of *Fossarus*, except PONDER's note on the brood pouch.

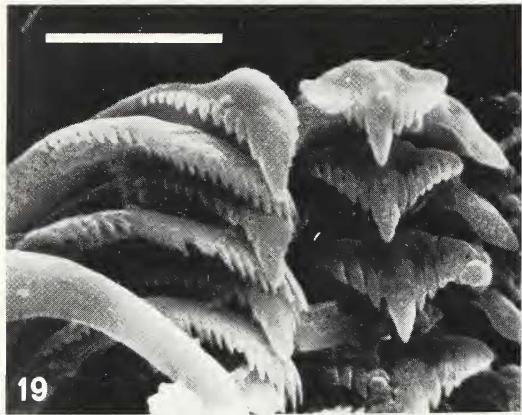
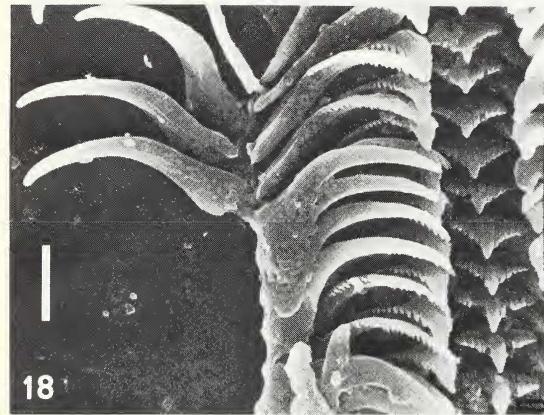
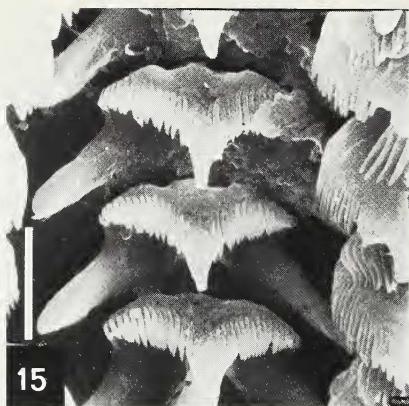
*Macromphalus* thus differs (cf. p. 84) from *Fossarus* in:

- 1) having a penis.
- 2) having a large fleshy epipodial flap on each side of the foot.
- 3) having tentacles that are round in cross section.
- 4) having a paucispiral operculum with lateral nucleus.
- 5) having oar-shaped marginal radular teeth.
- 6) having a foot that is divided in two sections, a posterior sucker-shaped one that presumably is used for attachment and an anterior motile part.

All these characters agree with *Vanikoro*, and we are not aware of any major differences in the soft parts between *Vanikoro* and *Macromphalus*. Therefore we find it justified to transfer *Macromphalus* to the Vanikoridae.

*Megalomphalus* and *Talassia* differ from *Macromphalus* in having a more normal foot, not divided so clearly into sections, but they have very similar epipodial folds and all other features observed agree with the Vanikoridae. We have therefore decided (as PONDER 1985 suggested for *Talassia*) to move them to Vanikoridae, where they can be regarded as less modified species.







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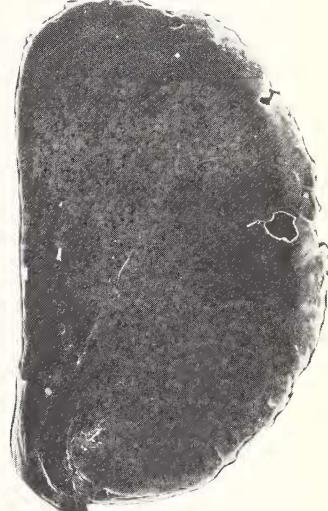
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Figs. 14-19. -14-15. *Macromphalus abyensis*, holotype. -16-17. *Megalomphalus disciformis*, CAN-CAP station 1.097, 32° 38' N, 16° 49' W, 193-196 m, S of Madeira, Rijksmuseum van Natuurlijke Historie, Leiden. -18-19. *Talassia* sp. THALASSA station Y405, 40° 33' N, 09° 27' W, 1170 m (off W Portugal). (MNHN.) Scale lines 10  $\mu$ m.

Figs. 20-25. -20. *Vanikoro ligata* as fig. 8, diameter 3.2 mm. -21. *Talassia* sp., as fig. 18, diameter 0.8 mm. -22. *Macromphalus abyensis*, holotype, diameter 2.4 mm. -23. *Megalomphalus disciformis*, Messina, Sicily, ex coll. Monterosato, diameter 1.5 mm (in Zoological Museum, Copenhagen). -24-25. *Fossarus ambiguus*, Calvi, Corsica, in- and outside, diameter 2.8 and 1.5 mm respectively (SMNH).

*Macromphalus* S.V. Wood, 1842

*Macromphalus* S.V. Wood, 1842:537. Type species, by monotypy, *M. reticulatus* S.V. Wood, 1842, Pliocene fossil, British Crag formation (fig. 16).

*Couthouyia* A. ADAMS, 1860:410. Type species: *Couthouyia decussata* A. ADAMS, 1860, by monotypy, recent, Japan.

**REMARKS:** We have, of course, not been able to examine soft parts or radula of the type species, but the similarities in shell characters of the type species, two undescribed Australian species that WARÉN has examined (unpublished) and the new species are enough to give this placement a sound basis.

Our synonymization of *Macromphalus* and *Couthouyia* is based only on shell characters, but we feel certain about it, as they are very similar and both fit into a large group of tropical species, of which we have examined the soft parts of several species.

*Macromphalus* differs considerably in shell characters from *Vanikoro*, but the similarities in the soft parts, as described below in *M. abyensis*, makes the position in Vanikoridae convincing. A foot divided in a posterior part for attachment and an anterior motile section is known, beside the Vanikoridae, only in *Amathina* GRAY, 1842 (Pyramidelloidea, cf. PONDER in press). The radulae of *Vanikoro* (figs 8-10) and *Macromphalus abyensis* (figs 14-15) are very similar and there are no noteworthy discrepancies in the external morphology of the soft parts.

*Macromphalus abyensis* n.sp. (Figs 5, 14-15, 22, 27-28, 42)

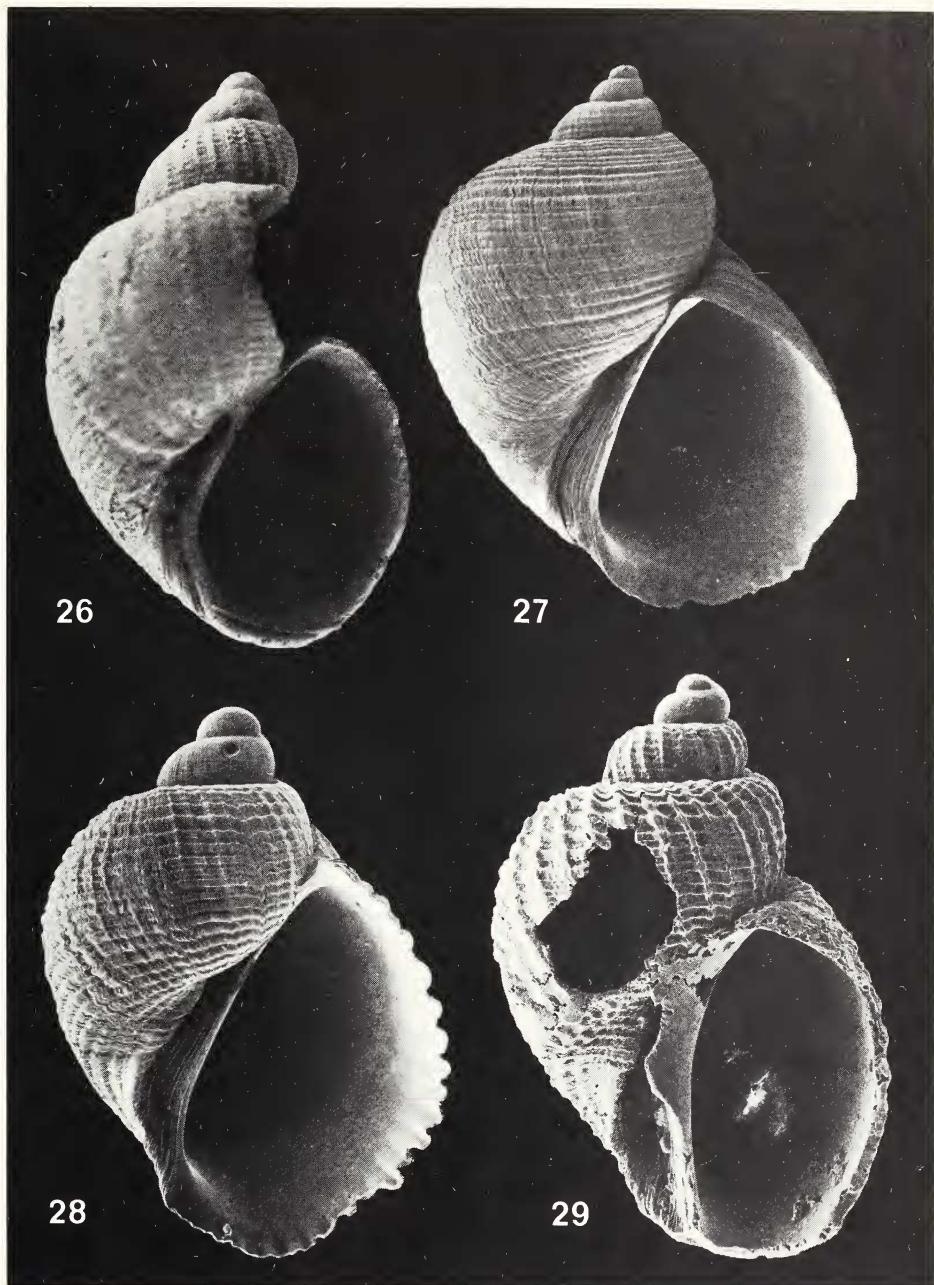
*Fossarus* sp. VAN AARTSEN & al. 1981, fig. 392.

**TYPE MATERIAL:** Holotype and paratypes in Museum National d'histoire Naturelle, Paris; 2 paratypes in the Zoological Museum of Amsterdam; 3 paratypes in Swedish Museum of Natural History no 3760; 2 paratypes in Museo Nacional de Ciencias Naturales, Madrid.

**TYPE LOCALITY:** Punta del Saudiño, Ceuta, Spanish Morocco (35° 54.3' N, 05° 18.0' W) in 40 m, washing of mixed hard substrates.

**DISTRIBUTION:** Also known from off Punta Bermeja, same area (35° 54.6' N, 05° 20.3' W) in 30 m, bottom of dead calcareous algae, 5 shells; Playa Benitez, same area, 35° 54.2' N, 05° 20.0' W, 12-20 m, 9 shells and specimens; Baia de Algeciras, S Spain (VAN AARTSEN et al. 1984 as *Fossarus* sp.).

**DESCRIPTION:** Shell (figs 27-28) fairly solid, grayish semitransparent, ovate with a high aperture and well developed umbilicus. The larval shell (fig. 42) consists of slightly more than one whorl. Its height is 340  $\mu$ m and it is sculptured by somewhat irregular rows of microtubercles visible as 6 fine lines under a good stereomicroscope. The holotype has 2 3/4 postlarval, convex whorls separated by a deep suture. The surface is covered by a strong sculpture of rough and sharp spiral ridges of varying size, about 5 at the beginning of the penultimate whorl, 25 at the beginning of the body whorl. The axial sculpture consists of close set and irregular incremental lines which give the whole surface a scaly appearance. The aperture is high and ovate, slightly pointed in its upper part and destitute of a thickened rib at the outer lip.



Figs. 26-29. -26. *Macromphalus reticulatus* (S.V. WOOD), syntype, British Museum (Nat. Hist.), Pal. reg. no. G 2058/1, 4.66 mm. -27-28. *M. abyensis*, holotype and paratype, 5.04 mm and 1.80 mm high. -29. *Macromphalus* sp., off Gorée, Sénégal. Height 2.9 mm (MNHN).

The umbilicus is rather narrow for the family, demarcated from the spirally sculptured area by a strong basal keel (more distinct in young specimens) and internally sculptured exclusively by strong axial growth lines marking earlier positions of the inner lip of the aperture.

**DIMENSIONS.** Height of the holotype 5.07 mm, diameter 3.52 mm, height of the aperture 2.92 mm, breadth 2.32 mm.

**OPERCULUM** (Fig. 22), large, filling all the aperture, very thin, slightly yellowish, paucispiral with very rapidly enlarging whorls.

**SOFT PARTS.** Figure 5 is drawn from the holotype when alive and differs considerably from the preserved animal in that the tentacles are long and slender and the sucker-shaped posterior part is not very well set off. (This is also the case in *Megalophthalus depressus*, where the sucker was noticed only in preserved animals.) The preserved animals are retracted about 0.1-0.2 whorls. The head-foot is comparatively small, in contracted state occupying less than 0.1 whorl. The foot is divided in two parts, a posterior, suckerlike section with muscular edges and an anterior long, tongue-shaped, probably very motile and extensile part. Centrally in the foot, just anteriorly to the sucker there is a large, crater-shaped opening with glandular walls, probably a posterior pedal gland. The propodium is almost as broad as the anterior part of the foot. On both sides of the foot, there is a large fleshy epipodial fold, running from the postero-lateral part of the opercular lobe forwards along the side of the foot to slightly behind and below the tentacles. The snout is short and broad, of even breadth from base to front and very flat. The mouth is ventral and situated well behind the anterior edge of the snout. The tentacles are very broad and flat (when preserved), divided in an anterior narrow part and a posterior much broader part. They are connected to each other by a thin membrane crossing the snout basally. The base of the tentacles is almost as broad as the snout and about eight times as broad as thick. Eyes large, diameter about 150  $\mu$ m, subcutaneous, situated just laterally to midpoint of base of tentacle. Pallial cavity broad and shallow, occupying only 0.2 whorls. The gill consists of about 30 low and triangular leaflets with the free corner drawn out to an indistinct tongue. The axis of the gill runs parallel to the pallial edge. Osphradium a double ridge running along central 3/4 of gill. The two ridges, of which the one closer to the gill is more narrow, are proximally united in a U-turn. The larger ridge distally splits into several smaller indistinct ridges while the smaller one simply ends at the same level. Pallial edge smooth, simple. The holotype is a female with a large, closed pallial oviduct with a single posteriorly and ventrally situated receptaculum seminis, filled with sperm and a strongly reduced penis just behind right tentacle, diameter about 80  $\mu$ m and 300  $\mu$ m long. Buccal mass large, muscular, with a pair of antero-dorsal solid, brown jaws, situated directly behind the mouth.

**RADULA** (Figs 14-15). Central tooth with very broad, V-shaped, basal supports, a large central cusp and ca. 14 long and slender lateral denticles. Lateral teeth thin and simple, with 1 major and 20-30 smaller, long and very slender denticles on each side of this. Marginals short and solid; outer one with distal, inner 2/5 and inner one with outer 2/5 denticulated.

REMARKS. The single adult specimen obtained (except empty shells), the holotype, was dried and after that soaked in water, in order to allow removal of the soft parts without risk of damaging the shell. Therefore no detailed observations of internal anatomy were done.

A second specimen with soft parts from the type locality had reached almost full size and has been saved preserved for future anatomical study; other paratypes are young specimens, maximum height about 2 mm, or shells.

*Macromphalus abyensis* bears some resemblance to two vanikorids reported from the NE Atlantic. *Couthouyia senegalensis* (KNUDSEN, 1956), described from Guinea, 8-18 m depth, differs in being much more slender, by having more than 4 postlarval whorls at a height of 4 mm, by lacking an umbilicus and by having a dominating axial sculpture of sigmoid, sharp ribs. Through the generical synonymy above, it is here transferred to *Macromphalus*. «*Fossarus reticulatus*» of JEFFREYS (1885:41) is probably different from *Macromphalus reticulatus*, the Crag fossil to which S.V. Wood (1842) gave this specific name, and still undescribed. JEFFREYS reported a single specimen from SW of Tanger, which differs from *M. abyensis* by having a dominating sculpture of straight axial ribs. It is very similar to the specimen in fig. 29, perhaps conspecific with it, but the condition of the two specimens does not allow description or safe determination.

The specific name *abyensis* comes from «*Abyla*» the roman name of Ceuta, and is given as a reminder of the kind reception and valuable support we got during our work there.

### *Megalomphalus* BRUSINA, 1871

*Megalomphalus* BRUSINA, 1871:9. Type species: *Stomatia azonea* BRUSINA, 1864, by monotypy, recent, Adriatic.

*Gyrodissa* DALL, 1896:44. Type species: «*Adeorbis depressus* JEFFREYS», by original designation, recent, Mediterranean.

REMARKS: Several of the generic names traditionally included in the Fossaridae will probably turn out to be closely related to, or synonyms of *Megalomphalus*, but this name is older and it is beyond the scope of this paper to revise all these names. Some of them are well figured by GOUGEROT & LE RENARD (1981) in their revision of the Eocene species of the Paris Basin.

Several names have been included in this genus from the European fauna:

*Maravignia sicula* ARADAS & MAGGIORE, in PHILIPPI, 1844:224. PARENZAN (1970:137) considered this name a senior synonym of *Megalomphalus azonus*. If this were correct, the name *Maravignia* ARADAS & MAGGIORE in PHILIPPI, 1844 would have to replace *Megalomphalus*, which is 27 years younger. ARADAS & BENOIT (1874:181) who can be considered first revisers, considered this a synonym of *Fossarus ambiguus* (L.), being based on a deformed specimen. Therefore *sicula* becomes a junior synonym of *ambiguus* and being the type species of *Maravignia* ARADAS & MAGGIORE, in PHILIPPI, 1844 it makes that generic name a subjective junior synonym of *Fossarus*.

*Heliciella mutabilis* O.G. COSTA, 1861:63. ARADAS & BENOIT (1874:182) considered this an older name for «*Fossarus petitianus*», but they did not use it. MONTEROSATO had earlier (1873) identified it as *Skenea* spp., and it is obvious that COSTA's two figures were prepared from two species. BRUSINA (1886) commented on it and concluded that none of the figures was prepared from *azonus*. We have not been able to identify it with *Megalomphalus azonus*, as ARADAS & BENOIT did. The figures show a shell rather similar to *M. azonus*, but the size indicated is 1 mm and it has at least two postlarval whorls. At the same size *M. azonus* hardly has one postlarval whorl and COSTA's measurements for other species described by him seem to be quite accurate. Neither have we been able to identify COSTA's species with any other Mediterranean species, and suggest that the name should be considered a *nomen dubium*, or secondly, that MONTEROSATO's identification should be followed, in which case the generic name *Heliciella* can be given *H. mutabilis* as type species. Then *Heliciella* which was described as a new genus, will not interfere with *Danilia* BRUSINA, 1865, which it otherwise may do as *H. costellata* COSTA, 1861 is a junior synonym of *D. tinei* (CALCARA, 1839), the type species of *Danilia*, and one of the two species included in *Heliciella* by COSTA. We therefore designate *Heliciella mutabilis* COSTA, 1861 as type species of *Heliciella* COSTA, 1861, to maintain the accustomed use of *Danilia* BRUSINA, 1865.

*Stomatia azonea* BRUSINA, 1865:29. We figure a syntype from the Zoological Museum in Zagreb (fig. 32). BRUSINA (1866, 1871, 1886) discussed this species, gave the synonymy and corrected the spelling to *azonus*, which has been followed by all later authors.

*Stomatia kutschigi* BRUSINA, 1865:29. No type material has been available, but from the description, it seems obvious that it is a real *Fossarus* and we consider it a synonym of *F. ambiguus*.

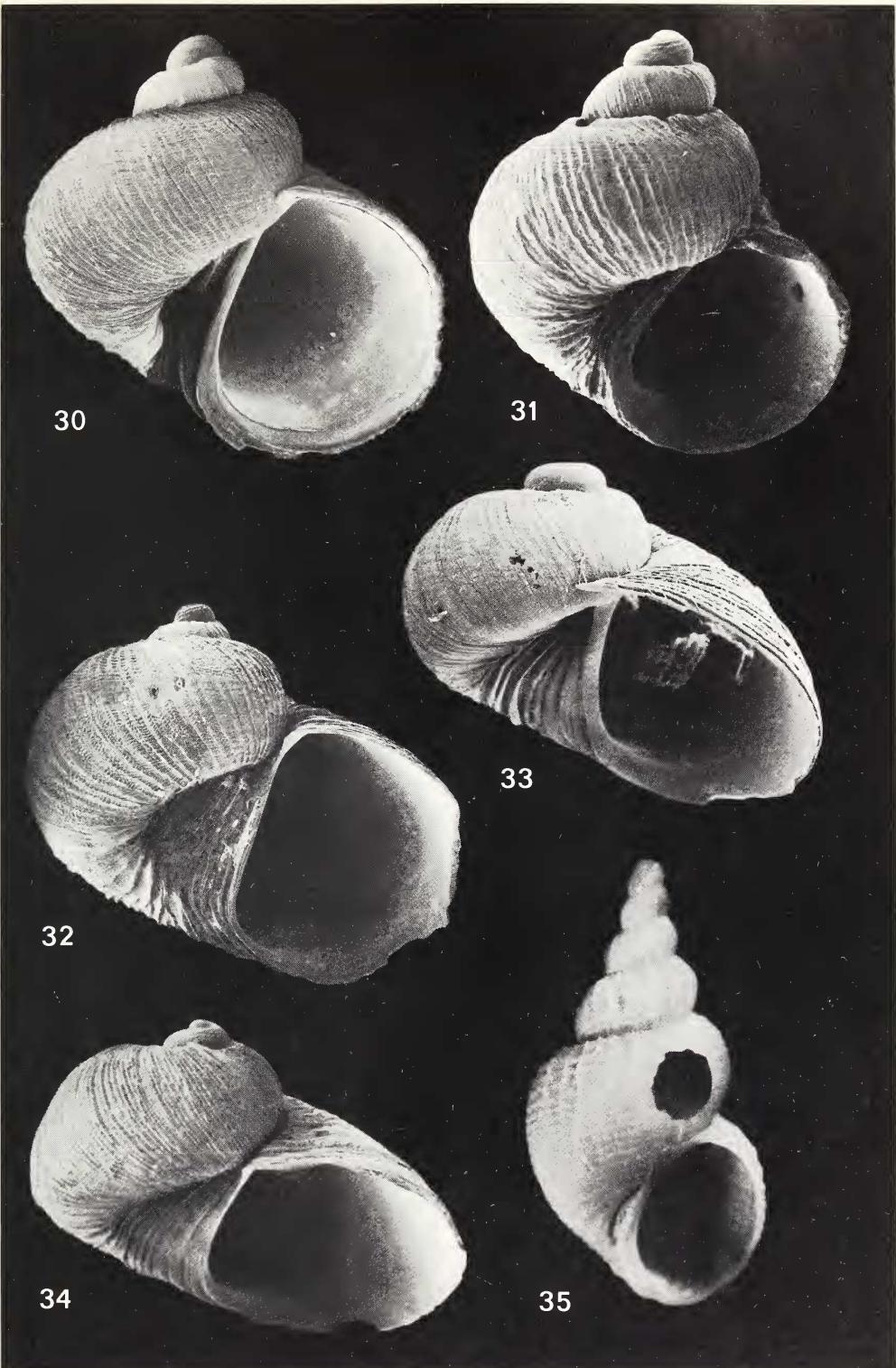
*Natica crosseana* KLECAK Ms, WEINKAUFF, 1868:257. The only information given about this name is that the two specimens sent to WEINKAUFF by KLECAK have lamellolose axial ribs, and it was included in *Natica*. KLECAK (1873) listed it as a synonym of *Fossarus petitianus* TIBERI. It has by later authors been identified with *azonus* BRUSINA, under which species the name can be kept as a junior synonym.

*Fossarus petitianus* TIBERI, 1869:179. We figure a possible syntype from N. TIBERI, now in the JEFFREYS collection (U.S. National Museum of Natural History reg. no. 186207), originally from the Gulf of Naples, one of the localities listed by TIBERI (fig. 36).

*Fossarus depresso* SEGUENZA, 1874:332. Described from Pleistocene deep water deposits at Messina. No type material has been available, but we figure a recent specimen, identified by MONTEROSATO, now in the Zoological Museum, Copenhagen (fig. 34). SEGUENZA's brief description «near *F. azonus* but more depressed» is perhaps not enough to consider it a validly described species, but it was described in more detail by SEGUENZA (1876: 180) who compared it with *F. azonus* and recorded it as recent from the Strait of Messina and by GRILLO (1877a:146, 1877b:15) and it was figured by JEFFREYS (1885, pl. 4, figs 8, 8a). The incomplete original description is probably the reason that DALL (1896) quoted the species as «*Adeorbis depresso* JEFFREYS», when assigning it as type species of *Gyrodissa*.

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Figs. 30-35. -30. *Megalomphalus azonus*, Djerba, Golfe de Gabes, intertidal, diameter 3.15 mm (SMNH). -31. *M. azonus*, determined *azonus* by MONTEROSATO, Palermo, Sicily, 2.45 mm diameter (Institut Royal des Sciences Naturelles, Bruxelles) -32. *M. azonus*, syntype, 3.4 mm diameter. -33. *M. disciformis*, as fig. 16, diameter 1.5 mm. -34. *M. disciformis*, Messina, det. *depresso* by MONTEROSATO, diameter 3.2 mm (Zoological Museum, Copenhagen). -35. *Constantia elegans*, probable holotype, height 3.9 mm (British Museum (Nat. Hist.), Mollusca Section reg. no. 1874.5.19.39).



*Fossarus excavatus* MONTEROSATO, 1875:25, 1877:33, (nom. nud.), was never described. We have examined a specimen in the DAUTZENBERG collection in Institut Royal des Sciences Naturelles de Belgique, sent to DAUTZENBERG by MONTEROSATO. It is the same species as that figured by VAN AARTSEN (1983: figs 1-4) as *Daronia exquisita* (JEFFREYS, 1883). A second specimen in USNM (186464) was examined by VAN AARTSEN (VAN AARTSEN & BOGI 1986:273) and proved to belong to another species, by these authors described as *Daronia monterosatoi* (see pp. 96).

*Adeorbis imperspicuus* MONTEROSATO, 1875:36 was introduced with the words «*A. imperspicuus* MONTEROSATO, nov. sp., zona degli abissi Palermo 90-110 m! Rassomigliante in piccolo all'*A. pulchralis*, S. WOOD, fossile del Crag» (resembling a miniature *A. pulchralis*). VAN AARTSEN & CARROZZA (1983) did not accept this as a formal description, but quoted MONTEROSATO in CHASTER, 1895 as author, a decision we agree with.

NICOLAY and ANGIOY (1980) figured three «syntypes» from the MONTEROSATO collection in Rome. (The specimens actually have no type status since the species was formally described by CHASTER, from British specimens). There seems to be no problem about the identity of this name. It was validated by CHASTER (1895) who described and figured it. The name is a synonym of *A. exquisitus* JEFFREYS according to WARÉN (1980:24) and VAN AARTSEN & CARROZZA (1983), in both cases based on comparison of type material. MONTEROSATO in several papers listed *imperspicuus* and *excavatus* = *monterosati* as different species and (1890:161) commented that they occur together. This seems to contradict our identification of *monterosati* (below). However, as VAN AARTSEN & CARROZZA (1983) mentioned, this species is somewhat variable in shape, and it seems possible that MONTEROSATO considered them different species.

*Fossarus monterosati* (sic!) GRILLO, 1877b:14 was introduced as a replacement name for *F. excavatus* MONTEROSATO, which GRILLO considered a secondary homonym of *Littorina excavata* C.B. ADAMS, 1852, by GRILLO considered to be a *Fossarus*. However, at the same time GRILLO presented a key for the determination of the Mediterranean species of *Fossarus*, which enables identification of *Fossarus excavatus* MONTEROSATO. Especially the description of the sculpture which was described as «spirolineati ou punctati» for the three species *azonus*, *depressus* and *monterosati* contributes to this, as the two former species fit the first adjective, while *F. monterosati* is one of the very few Mediterranean species that has a distinctly punctate sculpture.

WARÉN (unpublished) has examined this species alive at the Swedish west coast, where it sometimes is common in 25-50 m on muddy or silty bottoms, and the soft parts and the radula clearly indicate that this species does not belong to the Vanikoridae. VAN AARTSEN & BOGI (1986) recently described another species of «*Daronia*», *D. monterosatoi* which further increases the confusion among these names, as the latter name is not a homonym. In the end of this paper we introduce a new genus for *F. monterosati* GRILLO and discuss the systematic position of *D. monterosatoi* and the genus *Daronia*. *Daronia monterosatoi* VAN AARTSEN & BOGI is there provisionally placed in the archaeogastropod genus *Granigyra* DALL, 1889.

*Fossarus disciformis* TIBERI MS, GRILLO, 1877a:146 was introduced as a name for low, depressed specimens of *azonus*, which MONTEROSATO (1890) considered conspecific with *depressus* SEGUENZA.

*Fossarus (Megalomphalus) depressus* var. *disjuncta* GRILLO, 1877b:146, 1877a:15, described as: «anfracto ultimo disjuncto; umbilico magno valde plicato!», was evidently based on old specimens of *depressus*, where this is more pronounced.

*Lacuna azonata* LOCARD, 1886:291, is an unjustified emendation of *Stomatia azonea* BRUSINA.

*Adeorbis seguenzianus* TRYON, 1888:84, was proposed as a replacement name for *Fossarus depressus* SEGUENZA because of supposed secondary homonymy with *Adeorbis depressus* A. ADAMS, 1861. The species of A. ADAMS is of uncertain affinity; no types were found in British Museum of Natural History or in National Museum of Victoria, Melbourne. Therefore the secondary homonymy is very uncertain, but as the replacement name was introduced before 1961 it permanently invalidates SEGUENZA's name. However, the name *disciformis* TIBERI in GRILLO, 1877 is 11 years older and is a subjective senior synonym of *seguenzianus* TYRON, 1888.

*Macromphalina bouryi* (DAUTZENBERG, 1912) and *M. dautzenbergi* ADAM & KNUDSEN, 1969 were described from Senegal and Angola respectively and were well figured by ADAM &

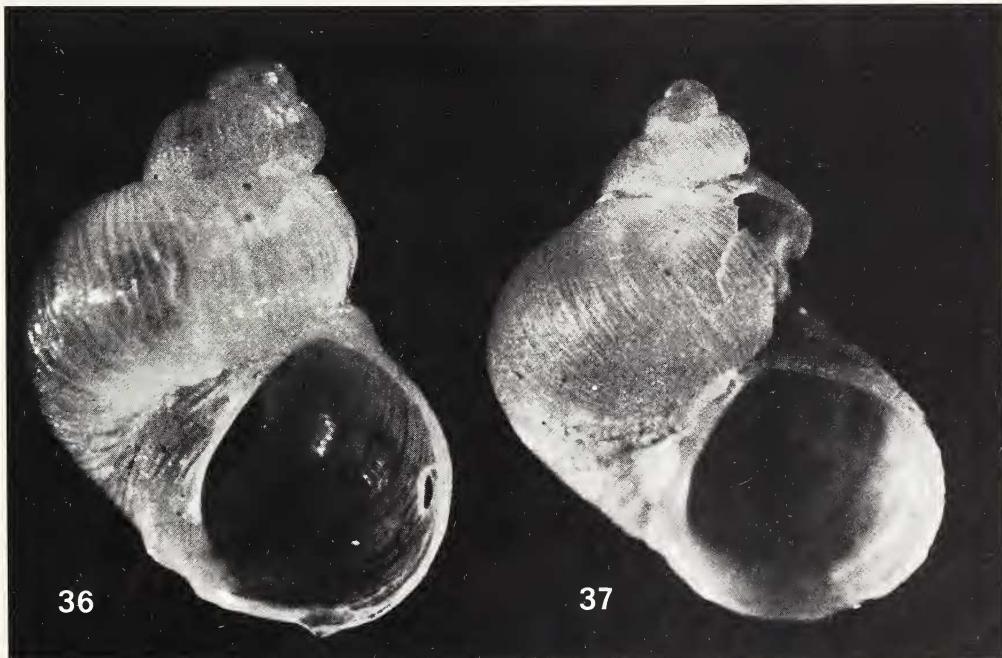
KNUDSEN 1969. They differ from the type species of *Megalomphalus* mainly in having a smooth larval shell of 2.5-3 whorls, instead of one with strong spiral sculpture and slightly more than one whorl, clearly a result of different types of larval development. We, therefore, can see no reason for generic separation and refer them to *Macromphalus*.

*Megalomphalus mercatoris* ADAM & KNUDSEN, 1969 was described from close to Conakry, Guinea, W Africa. We have examined the holotype and can see no difference from the low, finely sculptured specimen figured in fig. 34 and by MONTEROSATO identified as *depressus* SEGUENZA.

*Megalomphalus seguenzai* COSSMAN, 1918:99 is an unjustified emendation of *Adeorbis seguenzianus* TRYON (cf. above).

Of the specific names listed above, *kutschigi* and *sicula* are thus referred to the Fossaridae; *monterosati* (= *excavatus*) is considered of uncertain systematic affinity, but not a vanikorid; *bouri* and *dautzenbergi* are considered distinct species, readily recognized by their multispiral protoconch and belonging to *Megalomphalus*. Among the remaining names *Fossarus petitianus* seems to be readily recognized by its smaller size, high shape and a smaller umbilicus. We have, however, only seen two specimens from the JEFFREYS collection, a syntype from TIBERI (fig. 36) and a specimen sent to JEFFREYS by ARADAS, from Brindisi, Italy (fig. 37). Therefore it can not be excluded that they are two freak specimens although not giving an impression of that. The sculpture, development of the umbilicus and the morphology of the larval shell, seem to be similar enough to those of the type species of *Megalomphalus* to allow a placement in that genus although we have not seen any soft parts of *petitianus*.

Typical specimens of *azonus* and *depressus* (figs 31 and 34) look quite different. *Megalomphalus azonus* is somewhat smaller, higher with a more narrow umbilicus and more coarsely sculptured. These differences were also emphasized by NICOLAY and ANGOY (1980). Most specimens are, however, not very «typical», but rather intermediate (fig. 32) and the radulae can not be distinguished.



Figs. 36-37. *Megalomphalus petitianus* (TIBERI). -36. Syntype (U.S. National Museum of Natural History, reg. no. 186207), Golfo di Napoli, ex TIBERI, 1.74 mm. -37. Ex ARADAS (U.S. National Museum of Natural History reg. no. 181357), Brindisi, Italy, 2.52 mm.

Most specimens that we have seen come from shallow water (0-25 m) and they are more similar to *azonus* than to *depressus*; *depressus* is from deeper water (down to 195 m, fig. 33) and we suspect that it simply is a deep water form of *azonus*. We are, however, not certain about this and recommend that the two names should be used whenever it is possible to classify specimens as belonging to one or the other of the two forms, to avoid confusion if they should turn out to be distinct species.

We thus end up with the following species of *Megalomphalus* in the E Atlantic:

*M. azonus* (BRUSINA, 1865) (= *Natica crosseana* KLECAK MS, WEINKAUFF, 1868 = *Lacuna azonata* LOCARD, 1886). Southern Europe.

(=? *Fossarus disciformis* TIBERI Ms, GRILLO, 1877 = *Fossarus megalomphalus* (Sic!) var. *disjuncta* GRILLO, 1877 = *Adeorbis seguenzianus* TRYON, 1888 = *Fossarus depressus* SEGUENZA, 1874 = *Megalomphalus seguenzai* COSSMAN, 1918 = *Megalomphalus mercatoris* ADAM & KNUDSEN, 1969, Southern Europe and Western Africa.)

*Megalomphalus petitanus* (TIBERI, 1869). Southern Europe.

*Megalomphalus bouri* (DAUTZENBERG, 1912). Western Africa.

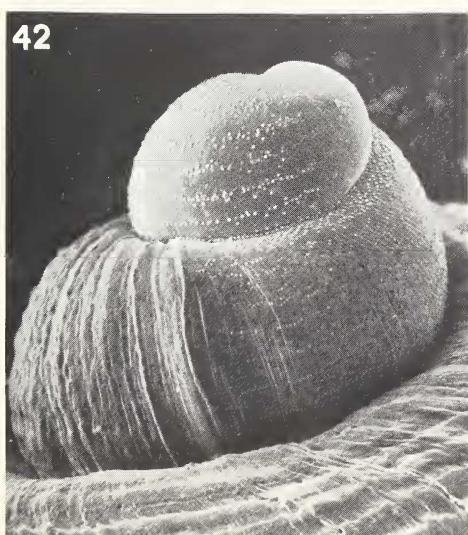
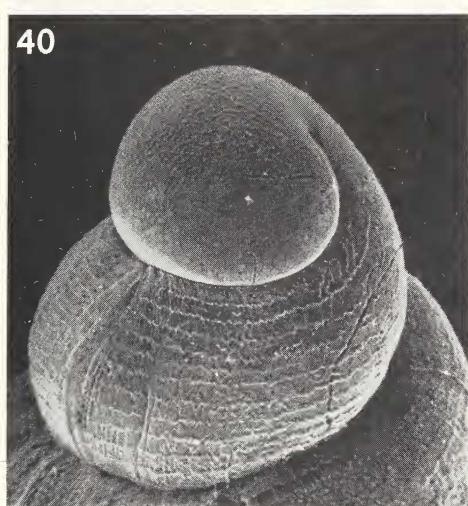
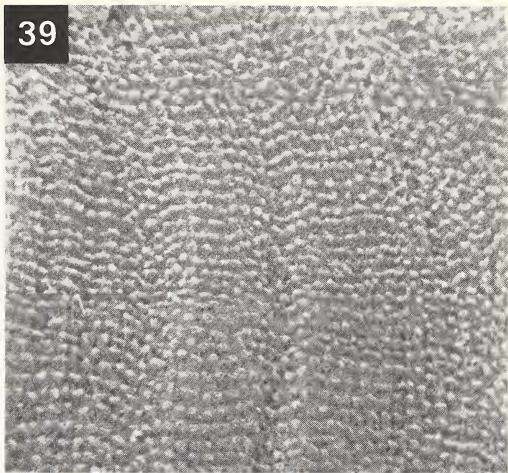
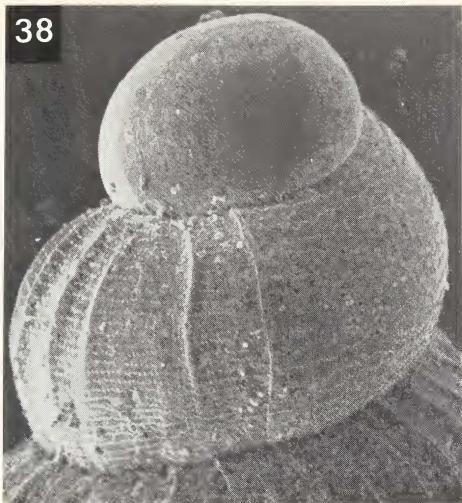
*Megalomphalus dautzenbergi* (ADAM & KNUDSEN, 1969). Western Africa.

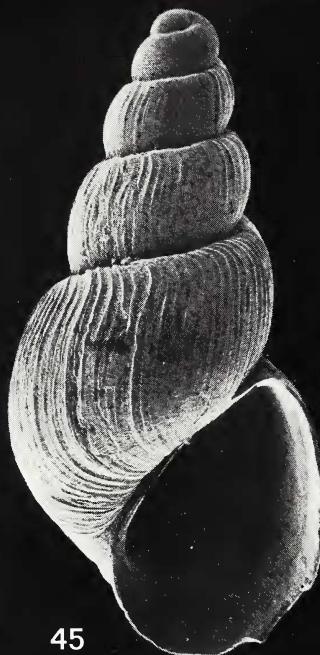
During field work at Djerba (Tunisia) in 1982, we found *M. azonus* to be common at the NW point of the island (Borj Djillidj), living under stones 0-1 m below low water level. It was only found under stones where there was good water circulation. Figs 6-7 were prepared from a specimen from that locality. The well developed, fleshy epipodial flaps and similarities in the radula clearly suggest a position in the Vanikoridae, but the sucker is not easily visible. However, examination of preserved specimens showed a small sucker-like organ on the most posterior, rather fleshy part of the foot, situated at almost a right angle to the sole of the foot, sometimes in an almost dorsal position. Therefore we can see no difficulty in including *Megalomphalus* in the Vanikoridae.

To what can be seen in figs 6-7 it should be added that the male has a small, simple penis, and that the animal is very shy and slow in its movements.

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Figs. 38-43. -38. *Talassia* sp., THALASSA station X363, 44°06'N, 04° 54'W, 630-545 m, S Bay of Biscay. Height of protoconch 0.34 mm (MNHN). -39. Sculpture of the same specimen, x 300. -40. *T. tenuisculpta*, syntype, (National Museum of Wales), height of larval shell 0.23 mm. -41. *Talassia coriacea*, Madeira, (Zoological Museum of Copenhagen,) height of larval shell 0.30 mm. -42. *Macromphalus abyensis*, syntype, height of larval shell 0.35 mm. -43. *Megalomphalus azonus*, Djerba, Golfe de Gabes, height of larval shell 0.25 mm.





*Talassia* n. gen.

TYPE SPECIES: *Rissoa? coriacea* MANZONI, 1868, recent, Madeira.

DIAGNOSIS: Vanikorids with a tall, rissoiform shell sculptured by low sigmoid lamellae, narrow or no umbilicus and with a simple foot with epipodial folds but without posterior sucker.

REMARKS: VAN AARTSEN (1984) pointed out that the name *Salassia* DE FOLIN, 1870 was based on a pyramidellid type species, *S. carinata* DE FOLIN, 1873, from W Central America. The name had previously been used for certain NE Atlantic species resembling and with some doubts referred to the Rissoidae (MONTEROSATO 1889), viz.:

*Salassia dagueneti* DE FOLIN, 1873 (N Spain) (fig. 45).

*Rissoa coriacea* MANZONI, 1868 (Madeira, ex coll MACANDREW, therefore probably dredged) (fig. 47).

*Rissoa tenuisculpta* WATSON, 1873 (Madeira, 40-90 m) (fig. 44).

The specimens on which these three names are based are quite similar. We have examined DE FOLIN's and WATSON's types, specimens identified as *coriacea* by WATSON and other material from the Bay of Biscay, S of Spain and from the Alboran Sea in depths between 50 and 1200 m, but have not been able to decide how many species that are involved. Examination of preserved specimens revealed soft parts very similar to those of *Megalomphalus azonus*, a foot without a sucker, large, fleshy epipodial folds and a radula of vanikorid type (figs 18-19). This supports PONDER's (1985:105) assumption that *tenuisculpta* WATSON and *coriacea* MANZONI might be related to the Vanikoridae, and we decided to introduce a new genus for these species.

We agree with PONDER (1985:105) that *Rissoa macrostoma* THIELE, 1925, from the Agulhas Bank belongs here. Also *Cingula sandersoni* VERRILL, 1884, belongs to *Talassia*, judging from shell characters (fig. 48). It was described from off Cape Hatteras (NE USA) in 250 m depth and only empty shells are known. WARÉN (1974:134) suggested that it belongs to Rissoellidae or Aclididae, which is obviously wrong.

Two genera, presently placed in Epitonidae (Wenz 1940) deserve comparison with *Talassia*: *Berthais* MELVILL, 1904, type species *Scala intertexta* MELVILL & STANDEN, 1903 (fig. 49) from the Gulf of Oman in 280 m and *Constantia* A. ADAMS, 1860, type species *C. elegans* A. ADAMS, 1860 (fig. 35), from the Strait of Korea, depth 113 m.

*Berthais* and *Constantia* differ from *Talassia* in having a strong, reticulated sculpture with straight axial ribs more similar to those of *Couthouyia*.

Both genera may turn out to belong to Vanikoridae when the family is better known, or the soft parts are known. *Berthais* may then turn out to be a junior synonym of *Cymenorhytis* COSSMAN, 1888 (type species *Melania fragilis* LAMARCK, 1804, Eocene, Paris Basin; for illustration see GOUGEROT & LE RENARD, 1981).

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Figs. 44-49. -44. *Talassia tenuisculpta*, syntype, (National Museum of Wales), 2.03 mm. -45. *Talassia dagueneti*, syntype, (MNHN), height 2.27 mm. -46. *Talassia* sp., as fig. 18, 3.56 mm. -47. *Talassia coriacea*, Madeira, (Zoological Museum of Copenhagen), 2.82 mm. -48. *Talassia sandersoni* VERRILL, 1884, syntype, (U.S. National Museum of Natural History, reg. no. 35447), off Cape Hatteras, 142 fathoms, 3.12 mm. -49. *Constantia intertexta*, syntype, (British Museum (Nat. Hist.), Mollusca Section reg. no. 1903.12.15.123), 6.8 mm.

## Concluding remarks

The addition of the three genera *Macromphalus*, *Megalomphalus* and *Talassia* to the Vanikoridae has substantially changed the concept of the family and a short diagnosis of the family as understood here, is justified:

**SHELL** small to medium size (2-20 mm), depressed to rissoiform, usually with a large and wide umbilicus, smooth or with strong sculpture.

**PLANKTOTROPHIC LARVAL SHELL.** Two to four whorls, smooth and with poorly developed sinusigera notch; or sculptured with spiral rows of tubercles or spiral ribs in combination with strong sinusigera notch (mainly in *Vanikoro*).

Foot with large fleshy epipodial folds running from opercular lobe to slightly behind tentacles. In *Vanikoro*, *Megalomphalus* and *Macromphalus* foot divided into posterior sucker-like part and anterior tongue shaped part.

**OPERCULUM** thin with rapidly enlarging whorls, present in all genera examined.

**RADULA** taenioglossate. Outer marginal tooth with about 1/3 of distal inner side equipped with comb-like denticles. Inner marginal tooth with similar denticles on its outer edge; both unusually solid. Lateral teeth with a major cusp at inner corner with 10-30 comb-like denticles at each side of it. Central tooth with a major cusp and 3-10 comb-like denticles on each side. Base simple with lateral supports, no basal denticles. The radula is short and broad, its length being 3-6 times its breadth. The teeth are situated unusually close to each other, i.e. numerous teeth per length of radula.

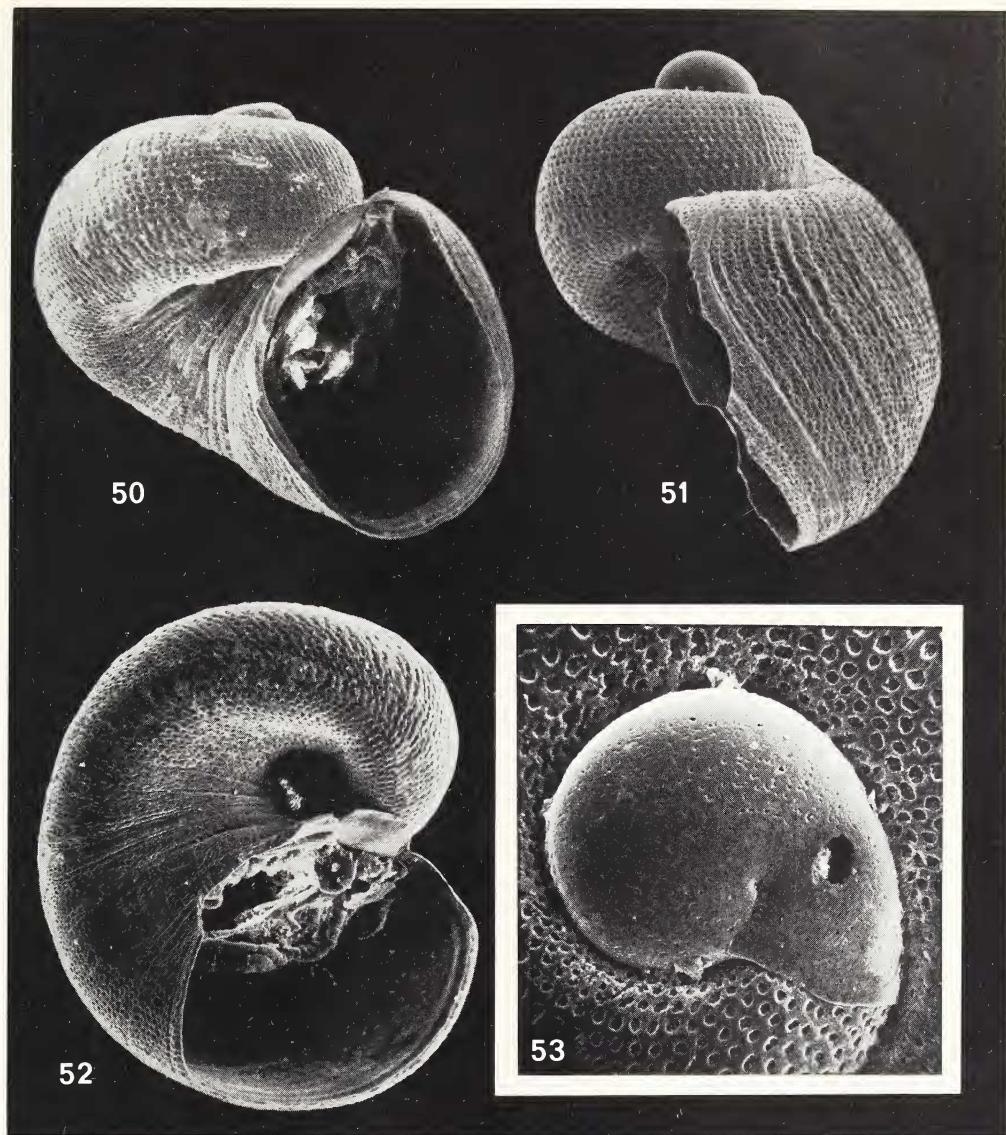
## *Tjaernoeia* n. gen.

**TYPE SPECIES:** *Fossarus monterosati* GRILLO, 1877. (If there should appear any presently unknown problems about the identity of this species of which there exists no type material, the identity is defined by reference to the synonym *Adeorbis imperspicuus* CHASTER, 1895. We prefer an identification with this name instead of *exquisitus* JEFFREYS, which was based on a young shell.)

**DIAGNOSIS.** Small, almost planispiral species with 1.5-2 teleoconch whorls of rapidly increasing diameter and a very deep and wide umbilicus. Teleoconch sculptured by a few incremental lines and numerous deep, sharply demarcated, pits arranged in spiral lines.

**REMARKS.** This new genus is introduced here to end the uncertainty about which genus to use for *Fossarus monterosati*. Work on the anatomy is presently going on and has indicated some affinity to the Pyramidellidae, where *Tjaernoeia* tentatively can be placed.

Mediterranean specimens of *monterosati* have a somewhat broader umbilicus and more slender aperture than Atlantic ones, and if they should turn out to be specifically different, the name *imperspicuus* remains available for the latter ones.



Figs. 50-53. *Tjaernoeia monterosati*, S of Lilleskär, Koster Area, Swedish west coast, 35 m. -50, diameter 0.7 mm, -51, height 0.6 mm, -52, diameter 0.7 mm, -53, diameter of larval shell 0.25 mm (all SMNH).

The name *Tjaernoeia* originates from Tjärnö Marine Biological Laboratory, close to Strömstad at the Swedish west coast, where *T. monterosati* has been found alive many times in 25-50 m.

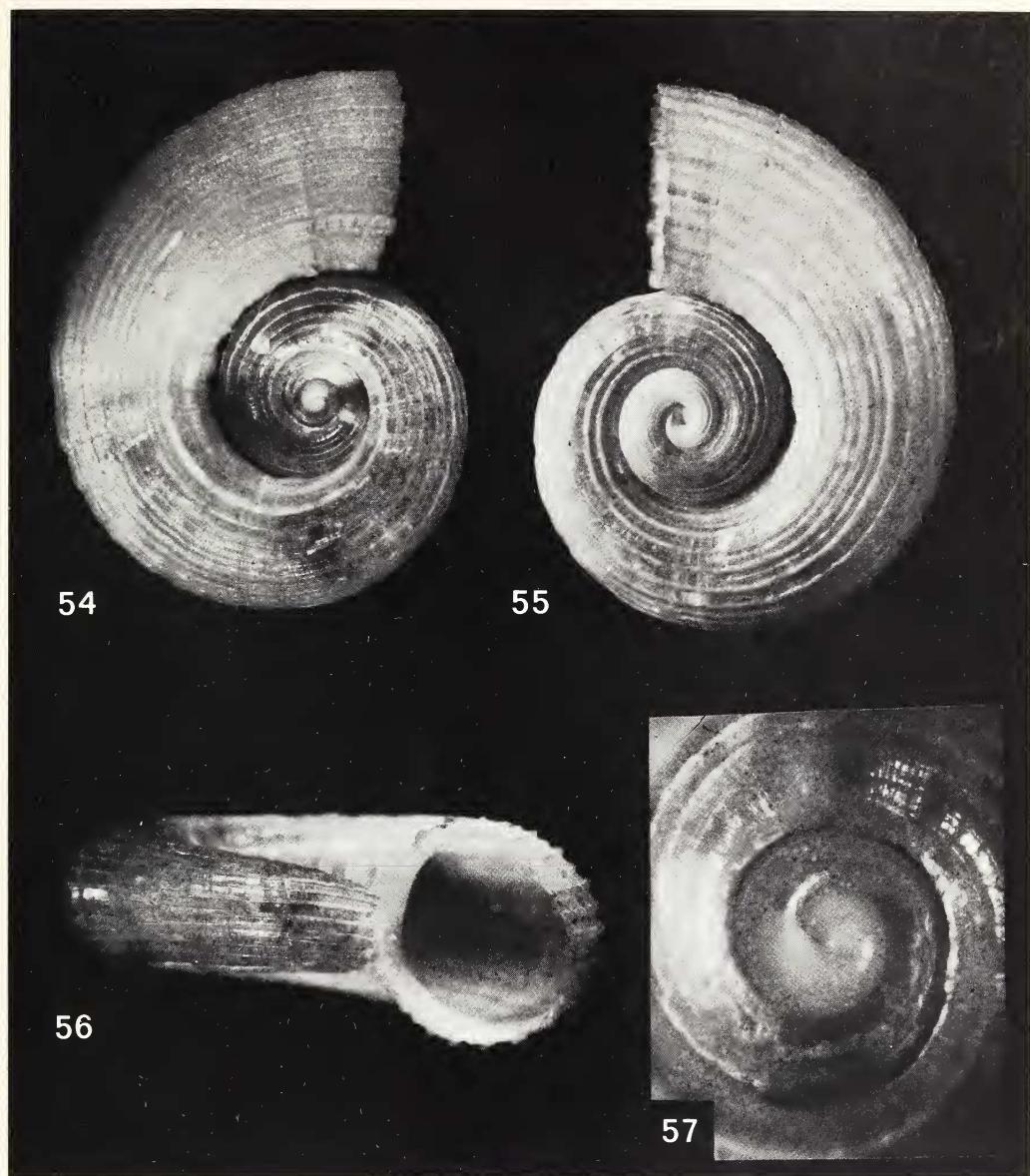
The second species sometimes placed in *Daronia* by European authors, *Adeorbis unisulcatus* CHASTER, 1897, is rather similar to *monterosati*, and has the same kind of sculpture, but has a strong basal furrow (figured by RODRIGUEZ BABIO & THIRIOT QUIEVREUX 1974, pl. II, figs a-e). It is not known from the Mediterranean.

*Daronia monterosatoi* van AARTSEN & BOGI, 1986, was described from 16 old and worn, probably immature shells from the Mediterranean. It differs from *Tjaernoeia* in lacking the pitted microsculpture. Instead it has a coarse, dense and irregular net-sculpture, more similar to what we have observed in certain deep-water species related to *Granigrya* DALL, 1889 and it could tentatively be included in that genus until specimens with well preserved shell or soft parts allow a more precise classification.

#### *Daronia* H. ADAMS, 1861

Species of *Tjaernoeia* have recently been included in *Daronia* A. ADAMS, 1861:244 which was described as a subgenus of *Cyclostrema* with *Cyclostrema spirula* A. ADAMS, 1850 as type species by monotypy. The holotype was said to have been found «on the sands in one of the Philippine Islands» (label) and «in the Philippine Islands» (description). The genus was later used as a subgenus of *Cyclostrema* for description of a few new Indo-Pacific species of uncertain affinity. PEILE (1936:144) described the radula and the jaws of one of these species, *C. subdisjuncta* H. ADAMS, 1868 and concluded that the species was related to the Vanikoridae. This note seems to have escaped the notice of later authors (e.g. WENZ 1940) who kept the genus in the «Cyclostrematidae».

Examination of the holotype of *Cyclostrema (Daronia) spirula* (Fig. 54-57), revealed that it is not related to *C. subdisjuncta*, which to us seems closely related to *Fossarella* THIELE, but that it evidently is a Cyclophoroidea, i.e. a terrestrial prosobranch, belonging to the family Poteriidae. Furthermore, it is so similar to *Buckleyia martinezii* (HIDALGO), the type species of this genus, that we do not hesitate to consider it an older synonym of *Buckleyia*. This genus is restricted to northern South America (WENZ 1938) and we assume that as so often is the case in the Cuming collection a confusion of localities has taken place. It is not without reason that Hedley (1913:259) called Hugh Cuming an «illiterate sailor».



Figs. 54-57. *Daronia spirula*, holotype, (British Museum (Nat. Hist.) Mollusca Section reg. no. 1968722). Diameter 11.5 mm. -54, apical view, -55, basal view, -56, apertural view, -57, apex magnified x 20.

## Acknowledgements

We want to thank the staff of the Croatian National Zoological Museum in Zagreb; the U.S. National Museum of Natural History, Washington D.C.; Institut Royal des Sciences Naturelles, Bruxelles; Rijksmuseum van Natuurlijke Historie, Leiden; Department of Paleontology and Mollusca Section, British Museum (Natural History); Zoological Museum, Copenhagen and the National Museum of Wales, who sent specimens for examination. Mrs Catherine Lamb corrected the English.

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Dr. Serge Gofas prepared the drawings of crawling animals and the SEM photography was done at the Centre de Microscopie du CNRS and at SMNH.

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### Note added in proofs

Since the above was written, A. Gaglini has published figures and comments on some European species of «*Cyclostrema*» (sensu classico) in *Notiziario C.I.S.M.A.* 10:3-15 («1987»). There she also gave a description of «*Fossarus excavatus* MONTEROSATO, 1875», and advocated the use of this name.

This is untenable. *Fossarus excavatus* MONTEROSATO was never described, and when GRILLO (1877b) substituted the name with *Fossarus monterosati* and presented information that allows identification of the species, that has to be taken as the formal description. Even if MONTEROSATO's name had been validly described by its author, the name *F. monterosati* must be considered a replacement name, and according to I.C.Z.N. art. 59b the replaced name is permanently invalidated since the action of replacing it was taken before 1960.